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Innovation in environment-oriented networks

Influence factors from case study and survey research

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Abstract

Purpose – The purpose of this paper is to outline and analyze the influence of environment-oriented cooperation on innovations as the important factor for sustainable development. The research question is how could environment-oriented cooperation contribute to innovations in enterprises?

Design/methodology/approach – For empirical research, a mix of methods is to be selected. At first, the results are obtained qualitatively and validated quantitatively afterwards. Two cooperation cases are selected: industry-related and intersectoral cooperation.

Findings – The paper explains the contribution of environment-oriented cooperation to realize innovations by identification of the innovation-relevant cooperation factors such as: heterogeneous constellation of the cooperation partners; specialist know-how exchange; coordination; and importance of industry orientation. These factors are also necessary for the implementation of sustainability-oriented innovation practices in a wider (economical, ecological and social) understanding.

Practical implications – The paper shows that an environment-oriented cooperation with different actors – which is coordinated by experts and concentrated on industry specific as well as oriented on the interests of all actors – can definitely help to realize potentials of innovation.

Originality/value – Concerning the increasing role of cooperation for the creation and implementation of environmental innovations, substantial awareness gaps are still observed. The paper has tried to identify and analyze cooperation characteristics which influence the implementation of environmental innovations and therefore the sustainable development.

Keywords Germany, Print industry, Sustainable development, Innovation, Channel relationships, Environmental innovations, Environmental networks, Influencing factors

Paper type Research paper



Introduction

The concept of sustainable development which we use as a conceptual starting point for our paper refers to “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (World Commission on Environment and Development, 1987, p. 8). Sustainable development can be regarded on three levels:

- (1) as a political concept at a local, regional, national, and/or international level;
- (2) as a normative-ethical concept; and
- (3) as an analytic concept (Eppel, 1999, p. 42; Urbaniec, 2009, p. 850).

This strategy aims to improve competitiveness and added value, in addition to the promotion of the environment, resource protection and the perception of social responsibility through ethical and social behavior (Rennings, 2005, p. 16; Pol and Ville, 2009, p. 880). Hence, it is understood as a concept that integrates economical, ecological and social aspects, which takes into consideration the qualitative differences between the three dimensions whenever feasible (Reiger and Egger-Steiner, 2007, p. 411).

In recent years, the concept of sustainability has been subject to extensive discussion, particularly with respect to environmental problems (Urbaniec, 2009, p. 1). The global effects of major environmental problems (e.g. climatic change), increased environmental awareness and complex environmental legislation have resulted in changes in the basic objectives or economical and managerial activities. According to Baumert (1997, p. 97), the ecological dimension has an inherent catalyzing key role in sustainability because it represents “qua definition – a holistic thinking and action model”, and is therefore particularly suitable for new directions.

Innovation research plays a crucial role for the realization of sustainability (Beckenbach *et al.*, 2005). The German and European economical and environmental policy (Luks, 2005, p. 41) state that innovation research is characterized by complex and nonlinear connected structures, providing an opportunity for more environmental protection and sustainability. In fact, environmental innovations are considered to reduce the consumption of resources and decrease environmental pollution (Hemmelskamp, 1999; Rubik, 2002; Gerstlberger *et al.*, 2010).

While efficient and competitive solutions for environmental sustainability should be pursued, a number of parameters contribute in the selection of innovation activities, including social acceptance. In fact, cooperation can play a decisive and important role for sustainable development (Gerstlberger, 2004; Urbaniec, 2009). Based on the concept of sustainable development, companies are not only encouraged to cooperate (e.g. inter-company cooperation or public-private partnership), but also to combine cooperation with the opportunity for innovation, and hence access to new markets (Bartelmus *et al.*, 2003; Hnatyszyn-Dzikowska and Łyszczarz, 2009). It is therefore necessary to promote cooperation between companies. Examples of such collaborations in agricultural, food processing and retail industries include: ecological joint training systems, technology transfer in the field of environmental techniques and the establishment of product-oriented networks (Urbaniec, 2009). Specifically, the cooperation and the dialogue between the government, public authorities, industry and other actors exhibit great potential for the realization of environmental innovations (Urbaniec, 2009; Berkes, 2009).

Informal networks are important within the diverse group of influential cooperative contributors that are relevant for innovation. For instance, recent studies on the influence of environmental policies on environmental innovations, indicated that the promotion of voluntary cooperation and agreements comprise a basic requirement for innovation-oriented environmental policy (Klemmer *et al.*, 1999, p. 41; Karl *et al.*, 2003, p. 207; Urbaniec, 2009, p. 849). Hence, the implementation of such agreements could potentially result in environmental demands being realized more effectively and more efficiently (Schaltegger *et al.*, 2005, p. 194). In this situation, cooperation in R&D forms a component of the influential industrial contributors, in addition to other parameters, such as market demand, technology parameters, company size, and market structure (Hemmelskamp, 1999, p. 88; OECD, 2009).

The determinants of environmental innovation vary depending on the object of a research study. For this reason, our study focuses on environment-oriented cooperation as influencing factor for environmental innovations. However, with respect to the role of cooperation towards creating and implementing environmental innovations, substantial research gaps remain (Urbaniec, 2009, p. 7). Such gaps may be attributed to the fact that current research is focused on:

- the analysis of just a selection of the possible influencing factors, such as environmental policy and technological development; or
- a missing fundamental appraisal of the effects of environmental innovation as a result of environment-oriented cooperation (Rennings, 2005; Kramer, 2006; Urbaniec, 2009).

In other words, the scope of these existing studies is not sufficient yet to adequately evaluate the various forms of environment-oriented cooperation. Hence, the evaluation of cooperation, for the creation and implementation of environmental innovations for both regional and national sustainability strategies, requires further clarification. Based on these observations, the cooperation-relevant conditions for the implementation of environmental innovations require addressing. Hence, this study first reviews conceptual approaches that are relevant to environment-oriented cooperation. We subsequently analyze cooperation-based influencing factors empirically (qualitative and quantitative), which are relevant to environmental innovations. Finally, we consider the implications of our findings with respect to sustainability-oriented and innovative management practices.

Conceptual approaches of environment-oriented cooperation

Unlike classic economic cooperation, environment-oriented cooperation is still a novel concept (Urbaniec, 2009, p. 48). This point of view reflects the fact that quantitative research in this field remains limited, despite an increase in the number of empirical studies available (Herde, 2003, p. 29; Rondinelli and London, 2003, p. 64; Hudson and Roloff, 2008, p. 228). For example, many qualitative studies primarily focus on the economical and ecological aspects of sustainability networks (Kirschten, 2005, p. 32). Hence, while the investigated networks claim sustainability, related qualitative studies do not consistently consider all possible dimensions of sustainability. For example, sustainable innovation networks are often realized in the form of regional networks (Gerstlberger, 2004) which are still not fully understood by innovation researchers so far. Hence, and due to the complex requirements of regional networks, they are basically understood in the context of cooperation between more than two actors (i.e. companies, research institutes, national and local administrative institutions or social participants). The common objective of the actors of regional networks is aimed towards innovation processes, which typically involve economic, ecological and social goals (Störmer, 2001; Gerstlberger, 2004). Therefore, due to the complexity of sustainable development, further investigation of such environment-oriented cooperation is both necessary and appropriate. Environment-oriented cooperation should be viewed as a comparable alternative to classic economic cooperation, since the cooperation between companies is not only developed for ecological reasons, but often for economic reasons, too.

The different definitions of cooperation within the environmental context are presented in Table I.

Author (year)	Definition
Götzelmann (1992)	Cooperation represents “a specific form of cooperation of an company with other companies, persons or institutions of the private or public sector which accommodates the characteristics of conscious action, autonomy as well as the interdependence” (p. 95)
Aulinger (1996)	“Cooperation serves to increase the efficiency by reaching of the goals of several participants, if equal interdependency exists between the goals of the involved ones” (p. 31)
Brockhaus (1996)	“It can be referred to as society-oriented cooperation, if the target groups from different social subsystems take part in an interaction process voluntarily and use common rules, standards or structures in order to discuss questions of common problems, to develop collective solutions, and if necessary, to realise them” (p. 61)
Krcal (1999)	By intercompany environmental protection cooperation “all forms of cooperation” are to be understood, “which enable a common achievement generation for the implementation of environmental activities by two or more partners (supplier, end-product manufacturer, waste management with the objective to increase the environmental compatibility of the products” (p. 9)
Kupp (2001)	Cooperation is “any form of voluntary and conscious collaboration for the achievement of common objectives [. . .], in which the cooperation partners remain legally and economically independent, whereas cooperation usually includes subareas of the task variety of the cooperation participants” (p. 61)

Table I.
Definition of
environment-oriented
cooperation according to
recent empirical studies

Based on the assimilated studies, there has been little emphasis on the environmental aspect in environment-oriented cooperation. In fact, except for the definition provided by Krcal (1999), the studies do not feature any explicit environmental reference. The cooperation concepts of the assimilated studies are based on classic definitions of cooperation, which were transferred to actual examples of environment-oriented cooperation between different participants. Furthermore, differences in environment-orientated cooperation were found to be related to the diversity of the involved participants (e.g. NGOs, politicians and companies). Therefore, these studies emphasize that environment-oriented cooperation generally occurs between companies and other social or political participants. Furthermore, politicians appeared to be participants for environment-oriented cooperation (Klemmer *et al.*, 1999, p. 116; Plummer and Gibbon, 2004, p. 65). Porter and Linde (1995, p. 133) found that “companies must become more proactive in defining new types of relationships with both regulators and environmentalists. Businesses need a new mind-set.”

The large number of definitions which are used in the literature indicates that the term “environment-oriented cooperation” may be formulated differently based on the precise objective of a particular cooperation (Table I). In order to conceptualize this term more precisely, it is essential to define the major characteristics of a particular type of environment-oriented cooperation clearly. Therefore, these fundamental characteristics require delineation. The appropriate central parameters of an environment-oriented cooperation should be clarified, including the circumstances for a generation and implementation of innovations, as well as detailing possible benefits and risks (Kupp, 2001, p. 61; Klutmann, 2003, p. 97; Plummer and Gibbon, 2004, p. 65).

Hence, in order for an environment-oriented cooperation to contribute to environmental innovations, the cooperation should fulfill certain requirements, such as the inclusion of

different participants and the development potential for environmental sustainability. Based on this consideration, the following constitutive characteristics can be defined to describe environment-oriented cooperation (Urbaniec, 2008, p. 52):

- voluntary and conscious cooperation between partners;
- common environmental goals and environment-oriented activities; and
- legal and economic independence of the cooperating partners.

These characteristics present a basis from which a continuative analysis of environment-oriented cooperation can be developed, which provides an adequate characterization of the observed features.

Therefore, the statement by Urbaniec (2008, p. 54), that:

[...] every form of voluntary and conscious cooperation between partners [...] in order to achieve environmental aims, with the assumption that cooperating partners are legally and economically independent from each other

should be interpreted as a definition of environment-oriented cooperation. Hence, environment-oriented cooperation has the capacity to strengthen relations between companies and other actors, which may also positively contribute to economic development. In addition, such cooperation may promote competitiveness as a result of collaborative innovations.

In fact, environment-oriented cooperation may include a diverse range of cooperation between (regional) actors. In the literature of both environmental economics and management, different aspects of cooperation are defined (Brockhaus, 1996; Strebel, 1990; Macharzina, 2003; Plummer and Gibbon, 2004). As a result, a number of different contexts exist for environment-oriented collaborations. These cooperation types may arise within industries as well as intersectorally. Overall, existing studies have interpreted such collaborations as market or society-oriented adaptation strategies of companies (Gerstlberger, 2004). Alternatively, such collaborations have been analyzed from the perspective of a pro-active ecological adjustment policy. Furthermore, environment-oriented cooperation may provide advantages in competition between businesses (Urbaniec, 2009).

Environment-oriented cooperation and innovative management

Both economic and management literatures discuss innovative management from the perspective of environment-oriented cooperation (Beckenbach *et al.*, 2005; Urbaniec, 2009). However, investigation of the importance of environmental innovations within environment-oriented cooperation has been limited in empirical studies, and usually as one parameter among many. Exceptions include Brockhaus (1996) who identified that society-oriented cooperation between companies and NGOs contributes to the innovation capacities of companies. In addition, Klemmer *et al.* (1999, p. 71) found that voluntary agreements between companies and political authorities contribute “in a limited way to the implementation of environmental innovations”. Conversely, such voluntary agreements may contribute to the accelerated diffusion of already existing environmental innovations. For example, in a large-scale survey by Cleff and Rennings (1999, p. 380), the influence of voluntary environmental agreements on environmental innovations in Germany was shown to have poor yields. This observation was further confirmed in a study by the OECD (Braathen and Johnstone, 2003, p. 22; Speirs *et al.*, 2008).

One other important research study was conducted by Störmer (2001). In the project “Regionale umweltinformationsorientierte Unternehmensnetzwerke” (RUN), he analyzed environment- and information-oriented companies networks at a regional level, which consisted of research groups, entrepreneurial and professional associations, as well as specific project groups (in the framework of programs including “Ökopartnerschaft” (ecopartnership) and “Ökoprofit” (ecoprofit). Owing to the negligible importance of the implemented action, network RUN was classified as “not strong concerning implementation of innovations” (Störmer, 2001). Furthermore, in specified implementation-oriented project groups (i.e. the ecoprofit program), already established concepts and tools were mainly used.

Empirical studies often query why only a low innovation effect has been achieved by environment-oriented cooperation (Kramer, 2006, p. 228; Cleff and Rennings, 1999, p. 380). One suggestion is that in such cooperation not all actors which are relevant for environmental innovation are involved. However, this topic requires more detailed investigation to determine which network participants are innovation-relevant, and which additional cooperation characteristics are crucial for innovation processes (Urbaniec, 2009, p. 73).

This paper evaluates a number of different empirical datasets to ensure the plausibility of the identified cooperation conditions. As a result, generalized characteristics and conditions of environment-oriented cooperation are identified, and subsequently verified from case study research in parallel to validation from quantitative analysis. Such detailed evaluation provides the necessary basis on which to explain the contributions made by environment-oriented cooperation to innovative management, as well as for the identification of the innovation-relevant cooperation factors necessary for the implementation of sustainable practices.

Data and methodology

As first step, we present and discuss qualitative data. These case study findings are subsequently validated by introducing additional quantitative results. To investigate how a voluntary inter-firm cooperation might contribute to business environmental innovations, and by taking the issue of research into consideration, we selected a case study of cooperation with the following criteria:

- ambitious cooperation goal with respect to innovation and environmental management;
- participants from the economic, scientific and political system; and
- sector-related and intersectoral cooperation due to the variability in environmental innovations between industries (Cleff and Rennings, 1999, p. 365; Hübner, 2002, p. 102).

For our qualitative analysis, the environmentally oriented network “Industrieabfall-Koordinierungsstelle Sachsen” (IKS; “Saxonian coordination agency for industrial waste”) in Eastern Germany was selected as framework. This network is considered to be the most innovative and successful example of environment-oriented cooperation in the environmental sector (particularly waste management) in Germany (IKS, 2000, p. 12). Based on previous empirical results which indicated that environmental innovations vary from industry to industry, an industry research group (“paper and print industry”) in the field of waste management was analyzed for this paper in-depth. This group represents

a complex example of cooperation along the value chain from the industries of paper manufacture and printing to disposal. Hence, we conducted seven exploratory in-depth interviews (duration: between two and three hours) with managers (3) as well as scientific (2) and political (2) experts to collect our qualitative dataset.

In the second step, for the quantitative research, a standardized questionnaire was designed. This questionnaire was conducted among all members of the “Bundesdeutscher Arbeitskreis für Umweltbewusstes Management e.V.” (BAUM; “German working group for environmentally oriented management – registered association”). This association is one of the most recognized and largest environmental federations in Germany. Furthermore, this association is the largest environmental initiative by manager themselves in Europe (BAUM, 2002). In addition, about 500 companies belong to this association which counts approximately 2,500 members. Totally, 49 questionnaires were completed and returned. This represents an acceptable return rate of 2 percent, given the conditions of an online survey with strong participation of small- and medium-sized enterprises in all German regions (Urbaniec, 2008).

Overall, the selected example of cooperation supports the current research process from different perspectives. On the one hand, it represents typical characteristics of environment-oriented cooperation. On the other hand, this case study represent appropriate examples of environmental cooperation, based on the content and formal criteria of the cooperation, such as the combination of participants and diversity of involved industries. Hence, it is possible to validate the quantitative findings by the qualitative research.

Findings: innovation-relevant features of environmental cooperation

Heterogeneous cooperation partners

In the empirical literature, predominant weight is given to participant diversity with respect to voluntary inter-firm and public-private cooperation. This is because the diversity of participants facilitates the exchange of non-technical resources between partners (Debresson and Amesse, 1991; Duschek, 2002, p. 43; Fichter, 2005, p. 183). Therefore, a broad spectrum of heterogeneous participants should be included to encourage innovations in environment-oriented cooperation. The integration of as many different partners as possible improves access to environmental knowledge and essential resources (Blazejczak and Edler, 1999, p. 44; Karl *et al.*, 2004, p. 2). Environmental innovations require specific inputs. But, as stated by Cleff and Rennings (1999, p. 33), they are not “self-runners” (Cleff and Rennings, 1999, p. 33). Hence, the range of different and required authorities for environment-oriented cooperation should complement one another.

Based on this discussion in the empirical literature, it is important to analyze the heterogeneity of actors also in our case study (i.e. research group “paper and print industry”) from different perspectives. For example, experts of paper, printing and waste management companies along the entire value chain are involved. However, according to environmental innovation, all actors in the network are identified as innovation-relevant. These actors represent:

- the private sector (i.e. companies);
- the public, respectively, political sector (i.e. Ministry of the Environment and Agriculture in Saxony and local/regional environmental authorities); and
- the scientific sector (i.e. a research institute).

Our case study shows that the learning aptitude of the involved companies developed as a result of industry-oriented exchange with heterogeneous actors. Despite, the technological differences, in part due to product differences between the companies, the cooperation between heterogeneous actors was regarded as stimulating for innovation. In this respect, access to different information sources was facilitated that may otherwise not be so easily accessed through the market, including data bases, magazines and manufacturers (von der Oelsnitz, 2003, p. 518).

Overall, we found also in our case study evidence that the combination of heterogeneous actors promotes a common learning process, which contributes to the improvement of innovation and environmental management of the involved companies. However, while these learning processes are important, they are not a sufficient prerequisite for generating and implementing environmental innovations. Only through the interaction with other company-specific parameters, such as the business culture, can the heterogeneity of the network participants lead to the realization of an innovative concept. This outcome is reflected in the level of cooperation between the actors and is correlated to an industry-common knowledge base. This knowledge base reduces the opportunity costs in terms of the transaction-cost approach (Williamson, 1981), and benefits the exchange of experience and information.

When the heterogeneity of actors is considered as an innovation-relevant characteristic in the context of intersectoral cooperation, we found that in our online survey 18 percent of network participants placed a high importance to cooperation with political partners and other companies (i.e. non-competitors). Furthermore, about 34 percent of participants stated that cooperation with other companies, research units, and competitors is relatively important. This finding was confirmed by 29 percent of participants stating that the role of cooperation – in general – is relatively important (Table II).

Cooperation and know-how exchange

A further cooperation characteristic which is discussed as relevant for innovation in the empirical literature (Duschek, 2002; Gerstlberger, 2004; Fichter, 2005) refers to the possibility for exchange of professional know-how. In our case study, the exchange of professional know-how was represented by the transfer of information and experience, with a heavy focus on the direct interests of the companies participating in the network. The industry-related cooperation topic spectrum ranged from common to highly specific topics of the heterogeneous participants. Examples of the topic range

Cooperation characteristic	Very important	Specification		Not important
		Relatively important	Relatively unimportant	
With political co-operation partners (e.g. environmental authorities)	18 (9)	22 (11)	10 (5)	6 (3)
With universities/research units	16 (8)	33 (16)	8 (4)	0
With other companies (e.g. suppliers)	18 (9)	35 (17)	4 (2)	0
With competitors	2 (1)	33 (16)	18 (9)	2 (1)
With all above-mentioned partners	0	29 (14)	16 (8)	6 (3)

Notes: Missing percent to 100 – no answer; percentage with number of participants in brackets

Table II.
Heterogeneity of
constellation partners as
a relevant cooperation
characteristic for
environmental
innovations

include in our case study the liberalization of energy markets, waste management, environmental costs, and market-relevant information.

An important component in the know-how exchange described in this paper is its high practical relevance and experience. The practical relevance becomes apparent in different cooperation activities, such as coordinated workshops with invited specialists and factory tours on the premises of the hosting company which is rotated. The transfer of professional know-how in the investigated cooperation was also realized by guest lectures and presentations about scientific and technological innovations, industry-related legal regulations and their application, projects of waste management in the State of Saxony, as well as experiences of comparable organizations in other federal German states. In fact, there is a strong recognition that knowledge transfer should relate to the innovative technologies of environmental protection, which are relevant for a specific cooperation (Kietz and Wille, 1999, p. 62; Claver *et al.*, 2007, p. 608).

The in-depth expert interviews of our case study confirmed that an exchange of experience has the potential to generate new innovation impulses. Furthermore, it also contributes to mutual comparison, which fosters further improvements and advantages, in effect reducing the “blindness” caused by routine work. Hence, the exchange of experience facilitates:

- the realization of various organizational and process-related improvements; and
- information access, not only about environmental law, but about developments and trends on regional and international markets, as well as new materials, technologies, know-how and inventions from research units.

In summary, the professional know-how exchange with different actors, concerning short-term developments and future trends, is a cooperation characteristic that is innovation-relevant. Professional know-how exchange is important for the creation and implementation of innovation, not only to ensure access to a breadth of information, but also for it to be established both sectorally and, most important, practically on the company level. Hence, different cooperation activities, such as factory tours or the exchange of experience and information, contribute to innovations in companies. Logically, a rich diversity of cooperation is particularly advantageous for the development of ideas and problem solving, and therefore the generation of innovations (Berkes, 2009, p. 1698). Existing empirical studies, about cooperation and innovation networks in general, have also already indicated the importance of factory tours within the framework of cooperation (Borchert *et al.*, 2005, p. 11). Overall, the exchange of professional know-how represents a cost-effective tool for the acquisition of information, because associated cooperation expenditures are relatively low. This was confirmed in our study by all the interviewed actors. Furthermore, experts play an important role for the exchange of professional know-how because they transfer innovation-relevant knowledge and know-how from their specific industries into the cooperation.

When considering the importance of specific know-how exchange as an innovation-relevant characteristic of intersectoral cooperation, our quantitative survey indicated that 45 percent of the investigated companies classified the practical application of the discussed issues as “very important” for the implementation of environmental innovations. Furthermore, the factory tours during cooperation meetings were also considered to be relatively important for 37 percent of the participants (Table III).

The high degree of heterogeneity of the technical spectrum represented within an intersectoral cooperation, resulted in a large variability in the interest of viewing different sites, and hence the relatively lower importance of factory tours. Furthermore, the size of the businesses involved may also be a contributing factor. For example, large-scale companies are not interested in a small- and medium-sized enterprises tour because their relative requirements are not comparable, except when they are both representatives of the same industry. Of additional interest, informal relationships were found to be relatively important, with respect to the specific exchange of information and experience (27 percent very important). In summary, our findings confirm the importance of specific know-how exchange as a cooperation parameter that has an impact on the realization of environmental innovations.

Coordination

Cooperation is often dependent on coordination (Brockhaus, 1996, p. 204). Coordination facilitates the agreement of common actions to be undertaken by cooperating partners. According to Wiesenthal (2001, p. 182), for political negotiations the presence and authority of trouble shooters and mediators applies “without a doubt in equal measure as the promotion of cooperation and innovation”, which is basically comparable to the cooperation investigated in the current study. The industry-related example of cooperation examined in this study, supports the prevalent finding of the declining role of the state as a regulator, and its increasing role as a moderator, in the handling of the economy (von Gleich, 1997, p. 24; Pujari, 2006, pp. 76-85). The theoretical and empirical literature also emphasizes the importance of an external coordinator, as a third party, for society-oriented cooperation (Brockhaus, 1996, p. 204; Berkes, 2009, p. 1699). In effect, the coordinator is a precursor of a new offer, from initiation to implementation, which is legitimized by the reliability of the represented organization (e.g. administrative authority, chambers of commerce, etc.). Since the different institutions, and the technical backgrounds of the actors, require coordination towards a common environment-oriented cooperation goal, the role of the coordinator is particularly important for cooperation when heterogeneous actors, institutions and technical backgrounds are involved (Urbaniec, 2009, p. 218).

Based on the observations in our study of both industry-related and environment-oriented cooperation, the coordinator plays an innovation-relevant role. The coordinator is responsible for the initiation and management of the cooperation,

Cooperation characteristic	Specification			
	Very important	Relatively important	Relatively unimportant	Not important
Specialist exchange of information and experiences	37 (18)	20 (10)	0	0
Applied importance of cooperation issues	45 (22)	10 (5)	0	0
Factory tours during cooperation meetings	4 (2)	37 (18)	6 (3)	4 (2)
Access to diverse information	18 (9)	29 (14)	8 (4)	0
Informal relationship between cooperation partners	27 (13)	27 (13)	2 (1)	0

Notes: Missing percent to 100 – no answer; percentage with number of participants in brackets

Table III.
Technical and scientific
know-how exchange as a
relevant cooperation
characteristic for
environmental
innovations

as well as directing the meetings of the workgroup. In such a positive scenario, a high level of quality of the cooperation activities and the know-how exchange are guaranteed. Furthermore, the coordinator encourages an open transaction of the cooperation, through the use of internal documentation as well as technical and scientific guidance. In the environment-oriented cooperation case presented here, the coordinator represents the interests of the Saxonian Department of the Environment, which functions as the institutional cooperation partner. The effectiveness of a coordinator, and intensity of support provided by the participants of the cooperation, may depend on the resources available for the coordination of the cooperation. In the examined case of industrial cooperation, financial support was ensured in part by the Saxonian Department of the Environment during the start-up period, and in part by the project and advisory activities of the coordinator.

Overall, the coordinators play an important role for environment-oriented cooperation due to their professional expertise and competency regarding organization and moderation. Personal experience enables the coordinator to increase the attractiveness of cooperation through the achievement of goals, as well as to stimulate the learning processes of the participants. In the context of industry-related cooperation that aspect was assessed also in our study. The coordinator was considered to be an intersectoral “multiplier” of environment-innovative industry solutions for Saxonian companies, and fulfilled an intermediary function between the economy (i.e. private-sector companies, federations), science (i.e. the research institute) and politics (i.e. the Department of the Environment of the Saxony State, political authorities).

From the perspective of intersectoral cooperation, our quantitative survey findings indicate that a significant amount of high importance (16 percent) was attached to the role of a coordinator from a company as an innovation-relevant characteristic by the survey participants. In contrast, coordination by scientific partners was considered to be “relatively important” by several of the companies (29 percent) that were investigated in our survey (Table IV).

Furthermore, the coordination by political representatives was considered as “relatively unimportant” by 29 percent and by neutral third parties (e.g. federations or associations) also as “relatively unimportant” by 27 percent of the survey participants. These results differ to the qualitative findings, which we obtained for industry-related cooperation. The reason for this discrepancy may in part be explained by the fact that the most of the interviewed experts represented larger companies, in which cooperation with political or public authorities is perceived as relatively unimportant.

Table IV.
Coordination as a relevant
cooperation characteristic
for environmental
innovations

Cooperation characteristic	Specification			
	Very important	Relatively important	Relatively unimportant	Not important
Coordination by third party (e.g. associations)	8 (4)	18 (9)	27 (13)	4 (2)
Coordination by political or public authorities	4 (2)	10 (5)	29 (14)	12 (6)
Coordination by universities/research units	6 (3)	29 (14)	16 (8)	4 (2)
Coordination by companies	16 (8)	22 (11)	14 (7)	2 (1)

Notes: Missing percent to 100 – no answer; percentage with number of participants in brackets

Importance of industry orientation

Industry orientation was also identified as a relevant cooperation characteristic in our case study, particularly with respect to the value added chain. Based on the position of the cooperation partners in the value added chain process, the industry-related case of cooperation exhibits both vertical and horizontal tradeoffs. Vertical tradeoffs occur between the up and down stages of the value added chain, for example from the paper manufacturing and the printing up to the disposal. Horizontal tradeoffs occur between industry competitors at parallel levels of the value added chain, for example between the examined printing companies in this study. The case of industry cooperation examined in this study was viewed as innovative by some actors, especially due to its exposure in the value chain. Hence, the way in which the relevance of innovation evolves within a specific industry and along the value chain requires consideration. Intersectoral cooperation, as second investigated cooperation option, was suggested to be the best way to solve specific internal environmental problems (e.g. questions of environmental costs) by some of the companies and experts that were investigated in our study.

Internal and interfirm improvements, as well as organizational solutions, can be developed through the involvement of both the up and down stages of the value added chain. An interfirm consideration extends the spectrum of industry-relevant processes and dependencies. This broad focus facilitates comprehensive problem-solving discussions, as well as the identification of activities for integrated solutions. There is potential for intersectoral cooperation to make an essential contribution to innovation. For example, the technological developments of the paper industry and its associated environmental problems have been discussed intersectorally in our case study network, while also including the down stages of the value added chain. Hence, within an environmentally oriented cooperation, the participating industries along a value chain are important towards validating innovation stimulation. This importance arises because these various industries conduct the necessary examinations of various technologies, products, or services with respect to their materials and energetic life cycle. The recycling and waste disposal management processes, from raw material production (i.e. paper manufacturing) to production (i.e. printing) and utilization, provide a number of opportunities for environmental innovation when dealt within the context of information exchange and level of experience of different parts of the value chain of the investigate industry.

In summary, the industry and value chain characteristics of environment-oriented cooperation facilitate the following practices:

- intense discussion about ecological, social, environmental, technological and market-related conditions;
- targeted idea and solution searches about environmental issues, which are necessarily associated with different environment conditions and may lead to new technological and organizational solutions;
- a number of synergistic possibilities through industry-related information exchange between the collaborating actors; and
- the ability of collective problem solving by the actors, and subsequent the realization of environmental innovations.

The importance of industry-oriented cooperation, in which as many levels of the value chain are included as possible, has been validated also for other industries. Examples include the automobile industry (“ARGE Altauto”; “working group old cars”) and the manufacturers of information technologies devices (CYCLE AG). Kirschten (2005) identified that participants integration at all levels of the value added chain is important for the success of innovation networks. Such cooperation simply facilitates the generation of collective problem solving and environmental decision making (Charnley and Engelbert, 2005; Isaksson *et al.*, 2010, p. 428). In fact, the absence of actors, from one or more stages of the value added chain, may negatively impact the entire innovation process, and hence the innovation network (Kirschten, 2005, p. 35).

The findings of our quantitative survey confirm the case study findings which we have presented so far. The participants of our survey attached a high relevance to the realization of environmental innovations in both industry-referred cooperation and in cooperation with partners along the value added chain (Table V).

There is high potential for innovation support both in industry-related cooperation (31 percent) and in cooperation with partners along the value added chain (31 percent). Of interest is that intersectoral cooperation was viewed as equally either “relatively important” or “relatively unimportant” (in each case 22 percent) by all examined companies. This finding may be explained by the dependency of innovation realization on the type of cooperation, as has already been indicated by the qualitative case study findings. In summary, these findings confirm the importance of industry-related cooperation with partners along the value added chain.

The qualitative and quantitative findings which we have summarized in this paper indicate that environment-oriented cooperation may open up a range of innovative possibilities. When cooperation characteristics are of an appropriate standard, such as the variety and quality of actors and coordination, they contribute to the generation and realization of environmental innovations in private-sector companies. However, cooperation characteristics alone are not sufficient to instigate the unfolding of an innovation effect. These characteristics must always be considered in combination with other factors which may also sometimes be outside of the sphere of influence of an environment-oriented cooperation. Since not all environmental cooperation is successful and innovation conducive, it was necessary to investigate under which conditions an environmentally oriented cooperation can be innovation conducive. It must be pointed out that the terms used in this paper (influencing factors) are not to be understood as normative but heuristic and explorative. In order to make them operational, in Table VI, the characteristics are emphasised which were determined concretely from our industry-related cooperation case.

Table V.
Importance of the industry orientation as a relevant cooperation characteristic for environmental innovations

Specification (importance)	Very important	Relatively important	Relatively not important	Not important
Industry-related cooperation	14 (7)	31 (15)	10 (5)	0 (0)
Intersectoral cooperation	12 (6)	22 (11)	22 (11)	0 (0)
Cooperation with partners along the value added chain	16 (8)	31 (15)	6 (3)	2 (1)

Notes: Missing percent to 100 – no answer; percentage with number of participants in brackets

Conclusions

Existing research has shown that cooperation strategies and management can play a crucial role for the realization of sustainability and environmental innovation on different levels (Hemmelskamp, 1999; Fichter, 2005; Urbaniec, 2009; Gerstlberger, 2004; Gerstlberger *et al.*, 2010). To address this general research question for the business level and especially small- and medium-sized enterprises, it is necessary to consider different characteristics that are related to both the actors and the actual process of environment-oriented cooperation even more in-detail than in existing research. Such characteristics can only be identified through better understanding how cooperating companies and organizations interact regarding environmental innovation. Our case study and survey data show that the characteristics that are most important for successful environment-oriented cooperation between small- and medium-sized enterprises and other companies, respectively, organizations can be parameterized as follows.

A high level of importance is attached to the coordinator of cooperation. The coordinator should be the initiator of the cooperation, with experience at creating proposals and solutions for environment-related issues. As such, the coordinator should aim to fulfill the following goals:

- the guidance and enhancement of environment-referred industry work, including new partners and tasks;
- contribution to the development of innovative solutions and projects;
- the provision of funding assistance at the interface between science and practice, in particular for small- and medium-sized enterprises; and
- communication about environment related issues between all involved collaborators, including the promotion of public relations.

The authority and reputation of the coordinator are of particular importance, and influence the successful generation of environmental innovations and their implementation to a high degree.

The heterogeneity of the participating organizations promotes the development of environment-oriented cooperation. Cooperation, in which actors from different types of companies, science and politics are present, facilitates access to a broad range of expert knowledge, which also activates quick learning processes and cross-fertilization (Berkes, 2009, p. 1698; Charnley and Engelbert, 2005, p. 165). Furthermore, the selection of participating companies and other organizations should take into consideration differences in certain characteristics, such as sector, position in the value chain, product range or technological state. This helps to avoid direct competition within environment-oriented networks, while encouraging open exchange between the actors, which in turn contributes to create the necessary level of trust (Berkes, 2009, p. 1699).

Cooperation characteristic	Features
(1) Heterogeneous constellation of actors	Economy, politics, science
(2) Professional know-how exchange	Practical reference (plant visits, wide range of know-how, informal relations)
(3) Professional coordination	Multiplicator, moderator
(4) Industry reference/value added chain	Printing, paper industry, waste management

Table VI.
Innovation-relevant
cooperation
characteristics and their
features

Mutual, industry-relevant competency knowledge among the non-entrepreneurial participants (e.g. universities, public authorities) is also necessary to generate and implement new solutions to problems. Furthermore, mutuality promotes informal relations among the cooperation partners, and subsequently helps to boost the innovation capabilities required for environmental innovations. Professional exchange between environment-oriented companies is also of particular importance, because of the high demand for information. Environment-oriented cooperation contributes towards the acquisition of new information, which is relevant for environment-oriented and other innovation activities. Specifically, the exchange of technical know-how among the heterogeneous parties had an innovative effect in our case study.

Finally, participation in an environment-oriented cooperation is an opportunity for companies to improve their image, and also, to increase trust between political or public authorities participating in the cooperation, the position of which is usually regulatory. The experiences from our case study in the German print and paper industry show that effective and useful cooperation work can be done if these managerial recommendations are considered during the preparation phase.

In summary, the theoretical and empirical contribution of our paper is that access to a (1) industry and/or value chain-oriented and (2) heterogeneous and (3) professionally coordinated spectrum of involved actors is a key success factor for environment-oriented cooperation on the company level as specific governance mode of environmental and innovation management. The risks of interorganizational networking, such as free rider problems or the “weakness of loose ties” (Orton and Weick, 1990), which are caused by a missing hierarchical governance mode, can be compensated by professional coordination without losing too many of the advantages of openness and “loose coupling” (Orton and Weick, 1990). This holds especially for small- and medium-sized enterprises.

Empirical specification increases the theoretical value and precision of our findings in comprehending the full spectrum of influencing factors in the cooperative innovation literature (Sawhney, 2003) and interorganizational relationships theories (Heidt, 2008). Of course, the limitations of our empirical study have to be taken into consideration for assessing our findings appropriately. We focused on factors which are directly related to environmental-oriented cooperation and did not control all other factors with potential relevance for environmental innovations (e.g. R&D expenses and staff, environmental management systems or environmental regulation). The inclusion of these factors beside cooperation patterns in an empirical research design would require either a large-scale quantitative study or a qualitative multi-case study. However, to be able to conduct such large empirical studies successfully more input from delimited and explorative studies on the company level is needed from different countries and sectors. Our findings refer to Germany and here the paper and print industry. A comparison of our findings with the results of similar studies from other OECD countries and industries which are still lacking for many countries and industries so far could be the next step to prepare international large-scale studies focusing on environmental innovation and cooperation.

Nevertheless, we can formulate a number of managerial recommendations based on our qualitative and quantitative study for managers, public servants and politicians, who are concerned about environment-oriented cooperation and innovation. First, a promoter, coordinator and moderator is crucial, who combines both in-depth expertise regarding the specific topics of the cooperation in question and strong personal leadership skills. Especially, in small- and medium-sized enterprises it is often

difficult to find a person with this profile. But, even if the selection of a professional and experienced coordinator is a challenge for many companies, he or she should be necessarily a business person to ensure cooperation between peers.

Second, the composition of network and working group participants must be conducted very carefully to ensure an adequate common knowledge pool. The challenge for the coordinator is here to find a balanced compromise between heterogeneity on the one hand and shared interests on the other. Experiences from earlier cooperation, bilateral exploration meetings with single potential participants or a preparation workshop with all possible participants could be used to cope with this challenge.

The same, as third managerial recommendation, holds for the activities to be performed in a network or working group. The cooperation portfolio must be structured in a way that reflects the heterogenous backgrounds and interests of all potential participants without losing a consistent structure and program. Furthermore, the coordinator must ensure that all participants will be provided with useful information from their specific perspective, without violating property rights or spreading confidential company knowledge.

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